graphic changes, in documenting the number of joints involved in the arthritic process and in ruling out arthritis by showing a normal bone scan. Detectable soft tissue lesions include tissue infarction (myocardial, bowel, rhabdomyolysis), some primary (neuroblastoma, breast, kidney) and secondary (osteogenic sarcoma in lung, carcinoid in liver) tumors and renal or urinary tract pathology (tumors, cysts, obstruction).

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Single-Photon Emission Computed Tomography Bone Imaging—A New Dimension in the Investigation of Back Pain

LOW BACK PAIN is ubiquitous. It is the cause of much suffering and often causes great frustration not only to patients, but to physicians managing such patients. Radiography, including computed tomography (CT), may show no abnormalities or may show structural abnormalities that, in a significant proportion of cases, are resistant to even radical forms of treatment.

Nuclear bone imaging basically shows areas of increased bone metabolism. Conventional planar bone imaging often provides suboptimal information because of its inability to precisely locate abnormal areas in the spine, such as the neural arch, apophyseal joints or adjacent vertebral bodies. Single-photon emission CT (SPECT) is a new, increasingly available technique that adds relatively little cost to routine bone scanning. It has the ability to produce emission CT images ("slices") in multiple planes and thus to increase sensitivity, reduce ambiguities and accurately locate sites of abnormal activity.

Insofar as pain is likely to be directly related to areas of abnormal bone metabolism—that is, due to abnormal stress rather than simply the presence of structural abnormalities—these areas can be localized precisely with SPECT. Such areas of functional abnormality may or may not be associated with the presence or indeed the specific location of structural abnormalities. The etiology of the functional abnormalities and consequent abnormal areas on bone scanning may be associated with tumor, infection, fracture or abnormal local wear and tear. For instance, there is evidence that the presence of spondylolysis, possibly associated with spondylolisthesis, in itself does not always produce symptoms, and that a local area of increased activity on a SPECT scan in the region of a pedicle or facet is a more specific indicator of the origin of the back pain.

The potential to precisely locate the actual cause of back pain has widespread implications. The ability to discern an abnormality in a spine that is essentially normal on an x-ray film or CT scan has significant clinical advantages. Furthermore, the possibility of localizing precisely an area of abnormal bone metabolism associated with structural abnormalities should help decrease the failure rate of some major surgical procedures such as for spondylolisthesis if it can be shown beforehand that the site of abnormal bone activity is not in the region of the spondylolisthesis but rather is related to abnormal wear and tear in an apophyseal joint. This could be easily verified and treated by injection.

In general, the capability to differentiate and precisely locate functional, active disease from solely anatomic changes can aid in the more specific and effective management of patients suffering from back pain.

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Single-Photon Emission Computed Tomography Using Thallium 201 for Evaluating Coronary Artery Disease

PLANAR MYOCARDIAL PERFUSION scintigraphy with thallium 201 is widely used for detecting, localizing and evaluating the extent of myocardial perfusion abnormalities and for differentiating infarcted from ischemic but viable myocardium in patients with possible or known coronary artery disease. With planar ^{201}Tl imaging, however, three-dimensional distribution of radioactivity in the myocardium is represented in a two-dimensional fashion, resulting in overlap of information among various myocardial regions. The planar imaging method, therefore, is not ideally suited to assessing location and overall size of ischemic and infarcted myocardium, the indices that are most predictive of prognosis in coronary artery disease. Single-photon emission computed tomography (SPECT) with ^{201}Tl, using 180° or 360° rotational angular sampling, offers true tomographic studies of myocardial perfusion with reduced overlap of various myocardial regions and improved image contrast. With SPECT, the presence and extent of perfusion defects can be objectively quantified. Several experimental and clinical studies have now shown that ^{201}Tl SPECT can accurately measure the size of ischemic and infarcted myocardium. Thallium 201 SPECT can also accurately detect and locate myocardial perfusion defects in patients with coronary artery disease.

Interpretation of SPECT images requires knowledge of normal regional attenuation patterns and attention to possible artifacts caused by patient motion, breast tissue and inappropriate image reconstruction. SPECT is more difficult to do and interpret than planar ^{201}Tl imaging. Although SPECT is now well validated as an accurate myocardial imaging technique, the degree to which this method will replace the simpler, more widely used and less expensive planar ^{201}Tl approach remains uncertain.

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